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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/823,059	04/13/2004	Alexis P. Bernard	TI-37332	3988
23494 7590 04/15/2008 TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265				
EXAMINER				
NG, EUNICE				
ART UNIT		PAPER NUMBER		
2626				
NOTIFICATION DATE		DELIVERY MODE		
04/15/2008		ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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# Office Action Summary

**Application No.**

10/823,059

**Applicant(s)**

BERNARD ET AL.

**Examiner**

Eunice Ng

**Art Unit**

2626

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 December 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-946)
- 3) ☒ Information Disclosure Statement(s) (PTO/SG/US)  
Paper No(s)/Mail Date 12/26/07.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Amendment***

1. In response to the Office Action mailed 9/24/07, Applicants have submitted an Amendment, filed 12/26/07, amending claims 1-5, adding new claims 7-9, without adding new matter, and arguing to traverse claim rejections.

### ***Response to Arguments***

2. Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new ground(s) of rejection, below.

### ***Specification***

3. The abstract and disclosure have been amended and these changes are acceptable. Thus, the objections have been withdrawn.

### ***Claim Objections***

4. Claims 1-3 have been amended and these changes are acceptable. Thus, the objections have been withdrawn.

5. Claims 1, 3 and 5 are objected to because of the following informalities: Line 11 of claims 1 and 3, and line 10 of claim 5, recite "coefficient  $\gamma_{if}$ " which should be --coefficient  $\gamma_{if}$ --. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

6. Claims 1, 4 and 5 have been amended and these changes are acceptable. Thus, the rejections have been withdrawn.

***Information Disclosure Statement***

7. The information disclosure statement (IDS) submitted on 12/26/07 was filed after the mailing date of the Non-Final Rejection on 9/24/07. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1, 3-5 and 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal et al. (hereinafter “Agarwal”), “Two-Stage Mel-Warped Wiener Filter for Robust Speech Recognition” (published 1999) in view of Bayya et al. (hereinafter “Bayya”), US Patent 6,446,038, and further in view of Bernard et al. (hereinafter “Bernard”), “Low-Bitrate Distributed Speech Recognition for Packet-Based and Wireless Communication” (published 2000).

Regarding claims 1 and 3, Agarwal teaches a method for performing time and frequency SNR dependent weighting in speech recognition comprising the steps of: for each speech frame or time period  $t$ , estimating the SNR to get time and frequency SNR information  $\eta_{t,f}$  and calculating the time and frequency weighting to get weighting coefficient  $\gamma_{t,f}$  wherein  $\gamma_{t,f}$  is a function of  $\eta_{t,f}$  (Section 2.1, Formulation of Mel-Warped Wiener Filter; Section 2.2, “Mel-

warped Wiener filter requires an estimate of the noise power spectrum...a precise estimate of noise is essential to insure the algorithm performance"; Fig. 2, frequency domain Wiener filter, a Wiener filter filters out noise that has corrupted a signal; the Wiener filter weights frequencies, and since Agarwal teaches a time-varying Wiener filter, Agarwal also teaches weighting in time).

Agarwal teaches in section 2.3 and Fig. 2, "frequencies of the mel-warped discrete cosine transform...transfer function of the Wiener filter in the frequency domain is then constructed...noise spectrum is estimated...subtracted from the power spectrum of the noisy signal...inverse Mel-DCT is computed to obtain the filter in the time domain." Agarwal does not teach spectral and cepstral distances, but Agarwal in combination with Bayya teaches: using an inverse DCT matrix  $M^{-1}$  to transform a cepstral distance ( $\sigma_t - \mu$ ) associated with the speech frame  $t$ , to a spectral distance; computing a weighted spectral distance by applying time and frequency weighting to the spectral distance employing a time-varying diagonal matrix  $G_t$  which represents the weighting coefficient  $\gamma_{t,f}$ ; and transforming the weighted spectral distance to a weighted cepstral distance employing a forward DCT matrix  $M$  to get a transformation matrix  $T_t$  (Bayya teaches in col. 3, ll. 1-8, "performing spectral analysis in different domains...speech samples may be analyzed according to...spectral analysis techniques...the cepstral coefficient vectors are used as features"; col. 3, ll. 30 – col. 4, line 32, "speech samples...transformed into an appropriate domain...2) Log spectral distance...6) LPC and PLP (Perceptual Linear Prediction) cepstral distances...cepstral coefficients...speech frames transformed into various domains").

It would have been obvious for one of ordinary skill in the art at the time the invention was made to combine the teaching elements of Agarwal with Bayya because Bayya teaches the “weighted cepstral distance measure is quite effective in equalizing the performance of the recognizer across different talkers” (p. 1419, end of 3<sup>rd</sup> paragraph).

Agarwal teaches providing the transformation matrix  $T_i$  and the original MFCC feature  $o_i$  that contains the information about the SNR to a recognizer (bottom of Section 2.3, “the power spectral density is then used to directly calculate the cepstrum for further processing in speech recognition systems”; section 3, experimental results, “mel-frequency cepstral coefficients”).

Agarwal does not explicitly teach, a recognizer including Viterbi decoding and performing weighted Viterbi recognition  $b_j(o_i)$ . However, weighted Viterbi recognition/Viterbi decoding is old and well known in the art as evidenced by Bernard in Section V. Weighted Viterbi Recognition (WVR), pp. 575-576. It would have been obvious for one of ordinary skill in the art at the time the invention was made to perform weighted Viterbi recognition because it preserves synchronization of the Viterbi algorithm and significantly reduces word error rate, as indicated by Bernard on p. 577, lines 7-9 of Section C.

Regarding claim 7, the limitations of claim 7 are the same as or similar to those of claims 1 and 3, rejected above, and thus are rejected for the same reasons.

Regarding claims 4 and 8, Agarwal suggests wherein the estimating the SNR to get time and frequency SNR information  $\eta_{t,f}$  is a pronunciation probability estimation (Section 3.2 teaches experiments with the AURORA database).

Regarding claims 5 and 9, Agarwal suggests wherein the estimating the SNR to get time and frequency SNR information  $\eta_{t,f}$  is a transmission over a noisy communication channel

reliability estimation (Section 1, ll. 1-4, teaches “speech recognition in an automobile noise environment, where colored noise with intensity as high as or even higher than the input speech”).

10. Claims 2 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal et al. in view of Bayya et al. and Bernard et al., and further in view of Pastor et al., US Patent 6,445,801.

$$\gamma_{t,f} = \frac{\sqrt{\eta_{t,f}}}{1 + \sqrt{\eta_{t,f}}}$$

Agarwal teaches Wiener filtering (pp. 1-2), which suggests wherein which guarantees that  $\gamma_{t,f}$  is equal to 0 when  $\eta_{t,f}=0$  and  $\gamma_{t,f}$  approaches 1 when  $\eta_{t,f}$  is large, the equation  $\gamma_{t,f}$  being a Wiener-type filter. It would have been obvious for one of ordinary skill in the art at the time the invention was made to use a Wiener-type filter because Wiener filtering enables the separation of the signals by decorrelation. Its importance is related to the simplicity of the theoretical computations. Furthermore, it can be applied to a multitude of particular processes such as the removal of a noise that is polluting a speech signal, as indicated by Pastor *et al.*, in col. 1, line 66 – col. 2, line 5. The equation  $\gamma_{t,f}$  is just an alternative method of performing weighting for emphasizing the signal or the noise.

***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Caceres et al. (US Patent 6,167,133) teaches echo detection, tracking, cancellation and noise fill in real time in a communication system.

Bruckner et al. (US Patent 6,678,657) teaches a method and apparatus for a robust feature extraction for speech recognition.

Hermansky et al. (US Patent 5,450,522) teaches an auditory model for parameterization of speech.

Boll et al. (US Patent 4,897,878) teaches noise compensation in a speech recognition apparatus.

Tohkura teaches "A Weighted Cepstral Distance Measure for Speech Recognition."

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eunice Ng whose telephone number is 571-272-2854. The examiner can normally be reached on Monday through Friday, 8:30 a.m. - 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Hudspeth can be reached on 571-272-7843. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/E. N./  
Examiner, Art Unit 2626

/David R Hudspeth/  
Supervisory Patent Examiner, Art Unit 2626